

## Transporting Patient with Suspected SARS

**To the Editor:** The severe acute respiratory syndrome (SARS) outbreak in Taiwan can be traced back to a Taiwanese businessman who returned from mainland China to Taiwan in March 2003 (1). In May 2003, several outer islands belonging to Taiwan reported SARS, and on June 2, 2003, Penghu Army Hospital reported a 40-year-old man with suspected SARS. The patient complained of shortness of breath and a dry cough. He had visited a person with confirmed SARS 7 days earlier. He had a temperature of 38.4°C and leukocyte count of 7,920 cells/ $\mu$ L, and his chest x-ray showed infiltration in both lower lobes.

Because medical facilities are limited on these islands, the Department of Health authorized the National Aeromedical Consultation Center (NACC), a physician-based 24-hour control center that coordinates all aeromedical transport of critically ill or injured patients within Taiwan, to coordinate transporting these patients to designated SARS hospitals in Taipei. The NACC dispatched an aircraft (Fokker 50) with a specialized team of two flight physicians, one flight paramedic, and a PIU (portable isolation unit) on board. During the flight, the medical crew prepared equipment and dressed themselves in three layers of personal protective equipment. On arrival at Penghu, only essential equipment was taken into the hospital. One physician took the PIU into the isolation room. The rest of the crew and equipment remained in the pre-isolation room. The patient was briefed about the transport and given 10 mg of metoclopramide to prevent motion sickness. He was asked to get into the PIU. A pulse oximeter was attached to his finger and placed inside the PIU so that it could be read from the outside. A ther-

mohydrometer was also placed inside the unit. The patient was given a squeeze-bottle of water, and the unit was sealed and inflated.

When leaving the pre-isolation room, the physician and the PIU were sprayed with a sodium hypochloride solution before the first layer of personal protective equipment was removed. At the exit, the entire medical crew removed a layer of personal protective equipment after being sprayed with sodium hypochloride solution. The team returned to the airport for the flight back to Taiwan. No other personnel or family member was allowed to accompany the patient on the flight.

The patient remained stable and calm throughout the flight. His oxygen saturation remained 97%–99% with heart rate of 90 to 100 beats per minute. Humidity was maintained at 60% and temperature at 28°C. On arrival, the team proceeded to the isolation ward. The physician accompanied the patient into the isolation room; the patient was released from the PIU and transferred to the receiving medical team.

On exiting the isolation room, the empty PIU and the medical team were sprayed with sodium hypochloride. All equipment was sprayed and put into biohazard bags. The medical team then discarded the last layer of impermeable clothing. The PIU was left in biohazard bags for 24 hours before being sprayed with water and air-dried.

After the assignment, the medical crew self-documented their temperature twice daily for 10 days. All staff remained asymptomatic with normal body temperatures during this period. The patient's temperature remained normal, and results of a polymerase chain reaction of throat swab were negative for SARS-associated coronavirus (SARS-CoV). He was discharged on June 10, 2003.

When the SARS outbreak occurred in Taiwan, many medical and ambu-

lance personnel were exposed to SARS-CoV while transporting or caring for patients with suspected SARS. As SARS was an emerging infectious disease, the mechanism of transmission was still unclear. Although one report by Christopher and Eitzen (2) suggested the value of an aeromedical team to evacuate patients with suspected lethal, infectious diseases, limited evidence supported a safer means of transportation that would possibly reduce transmission of SARS to persons taking part in the mission.

When the SARS epidemic spread to remote islands, aircraft companies refused to transport patients with a case of suspected SARS unless certain precautions were implemented. Smaller aircraft used on domestic routes in Taiwan do not meet the standards set for transporting SARS patients (3,4), which prompted the design of the PIU, an airtight polyvinyl chloride bag with a one-way inlet valve and an exhalation valve. The valves were modified by incorporating HEPA filters on both sides of the valves and then connecting a ventilator with an oxygen source to the inlet valve. The respiratory rate and tidal volume are set, depending on weight and oxygen requirements of the patient. By regulating the exhalation valve, the minimum pressure inside the bag can be manipulated to keep it from collapsing, since the bag has no internal or external frame.

The PIU has some limitations. No physical contact with the patient is possible after the PIU is sealed and inflated. Very strict criteria on the suitability of a patient to be transported are followed. Any patient who is unconscious, uncooperative, or whose condition may deteriorate is not transportable in this unit. Because of possible discomfort, a maximum total transport time of 2 to 4 hours is suggested. This time frame works well in Taiwan; all locations in the country, including the outer islands, are within a 4-hour limit.

The use of PIU during the SARS crisis had a number of positive effects in Taiwan. It enabled the safe transport of SARS patients between hospitals by air and road and decreased the risk of cross-infecting transport personnel. The anxiety of transport personnel was decreased, as was the fear felt by the population of the outer islands. In addition, the credibility of the local health authorities was improved among the general population in Taiwan.

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### References

- Center for Disease Control, Department of Health, Taiwan. Prevention and control of SARS in Taiwan (2nd edition). Sindian (Taiwan): Yu Hwa; 2003.
- Christopher GW, Eitzen EM. Air evacuation under high-level biosafety containment: the aeromedical isolation team. *Emerg Infect Dis.* 1999;5:241–6.
- Centers for Disease Control and Prevention. Interim guidance: air medical transport for severe acute respiratory syndromes (SARS) patients [monograph on the Internet]. 2003 May 8 [cited 2003 Jun 28]. Available from: <http://www.cdc.gov/ncidod/sars/airtransport-sarspatients.htm>
- Interim Domestic Infection Control Precautions for aerosol-generating procedures on patients with severe acute respiratory syndromes (SARS). Centers for Disease Control and Prevention. 2003 May 20 [cited 2003 Jun 28]. Available from <http://www.cdc.gov/ncidod/sars/aerosolinfectioncontrol.htm>

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## Psychosocial Impact of SARS

**To the Editor:** An outbreak of severe acute respiratory syndrome (SARS) occurred from February to May 2003 in Hong Kong, China, Singapore, and Canada. According to the World Health Organization, 1,755 people were infected in Hong Kong; 386 of these were healthcare workers. A total of 300 persons died from SARS, constituting a death rate of 17% (1).

Evidence suggests that persons infected with SARS recovered physically, but SARS is associated with social and psychological problems poorly understood by the scientific community. A survey in a convalescent hospital in Hong Kong showed that approximately 50% of recovered SARS patients showed anxiety (2), and approximately 20% were fearful (2). Approximately 20% of the rehabilitated patients showed some negative psychological effects (3), which included insomnia and depression. Some patients with serious cases could not rid themselves of the memories of fighting SARS, and these memories disrupted their daily activities. These psychosocial problems may be due to the complications of

SARS medications, such as ribavirin and corticosteroid. Persons who took these drugs had hair loss, major memory loss, impaired concentration, and depression. A medical practitioner in Hong Kong who recovered from SARS attempted suicide because complications from drugs made him unable to earn his living (4).

In addition to SARS patients themselves, an estimated 50% of family members of SARS patients had psychological problems, including feelings of depression or stigmatization (5). They had difficulties sleeping, and some children who had lost parents cried continuously. Some children also felt embarrassed to be a member of a SARS family (6). The spouse of one healthcare worker who died from SARS attempted suicide at her workplace (7). The loss of parents who were SARS patients also impaired the growth of their children (7). A study conducted in China (8) reported that negative SARS-related information increased persons' perception of their risk and led to irrational nervousness or fear.

Although data from systematic studies of SARS do not exist, evidence suggests that this disease has psychosocial consequences for SARS patients, their families, and society. While biomedical scientists must continue their efforts to clarify the genetic makeup of the SARS coronavirus, look for new medications, and develop vaccines (9–13), the social and psychological aspects of SARS should not be overlooked. Since nearly all resources are devoted to biomedical research and medical treatment, psychosocial problems of SARS patients and their families are largely ignored. Our review of the literature using the ISI Web of Knowledge on January 17, 2004, substantiated this observation. To date, no systematic study examining psychosocial consequences of SARS has been published in scientific journals. A systematic exploration of how SARS negatively affects patients'